THE EFFECTS OF TRAINING AND DISUSE ON MUSCLE FATIGUABILITY

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The focus of this presentation will be on the effects of disuse and training on muscle fatiguability. Disuse leads to many well know changes in the muscle, including the development of atrophy and weakness. In contrast, however, the fatigue characteristics of the muscle have been reported to be well maintained, in spite of significant decreases in oxidative metabolism. Lower maximum motor unit firing frequencies may help to better preserve membrane excitability in disused muscles. The fact that the sarcoplasmic reticulum may be less affected than the myofibrillar proteins may help to preserve excitation-contraction coupling. However, there may be a limit to this adaptability. Indeed, a decrease in muscle endurance has been observed in the plantarflexors of subjects whose ankle had been internally-fixated following an ankle fracture in comparison to those who had sustained external fixation or to healthy controls. Greater muscle endurance has been reported following strength training when the muscle is performing against the same work load. If the muscle is working at similar intensities, the effects of training have been more equivocal. A combination of strength and endurance training, as seen in elite rowers, however, does lead to improved muscle endurance, even when working at same relative work load. Indeed, elite rowers were able to complete significantly more contractions at 50% of their maximum voluntary contraction than novice rowers. This better performance could not be explained by differences in central drive, neuromuscular propagation, or excitation-contraction coupling, suggesting that a more efficient metabolic milieu may be responsible for their greater endurance. In conclusion, in contrast to muscle size and strength, which are highly dependent on the levels of muscular activity, muscle fatiguability is relatively insensitive to external demand. Indeed, there appears to be a threshold effect in that within a fairly broad range of activity, muscle fatiguability is not affected. If the external demand drops below a certain level, however, muscle endurance is compromised whereas it is ameliorated if the external demand reaches an undetermined critical level.